

CLAIMS

1 1. A magnetostrictive torque sensor, comprising:
2 a rotating shaft rotating around a center axis and
3 having magnetostrictive characteristics; and
4 a cylindrical ferrite magnetic core disposed at a
5 predetermined distance from an outer periphery of the
6 rotating shaft and coaxially with the rotating shaft, and
7 provided with a coil having an insulation coating to detect
8 a strain of the rotating shaft on its inner peripheral
9 surface;

10 wherein:

11 the cylindrical ferrite magnetic core comprises a pair
12 of opposed coil-forming inner peripheral surfaces formed by
13 dividing the inner peripheral surface into two parts along
14 a plane including the center axis; and

15 the coil has, on each of a pair of the opposed
16 coil-forming inner peripheral surfaces, a first coil
17 including a forward current coil and a feedback current coil
18 connected in series and disposed at a same position inclined
19 with an angle of $+45^\circ$ to the center axis, adapted to flow a
20 forward current and a feedback current in a same direction
21 and, and a second coil including a forward current coil and
22 a feedback current coil connected in series adapted to flow
23 a forward current and a feedback current in a same direction,
24 and disposed at a same position inclined with an angle of -45°
25 to the center axis and crossing with the first coil.

1 2. The magnetostrictive torque sensor, according to
2 claim 1, wherein:

3 the cylindrical ferrite magnetic core includes a pair
4 of semi-cylindrical ferrite magnetic cores divided into two
5 parts along a plane including the center axis.

1 3. The magnetostrictive torque sensor, according to
2 claim 1, wherein:

3 the forward current coil and the feedback current coil
4 of the first and second coils include forward current coils
5 and feedback current coils, which are continuously extended
6 by horizontal conductors and vertical conductors.

1 4. The magnetostrictive torque sensor, according to
2 claim 3, wherein:

3 the horizontal conductors and the vertical conductors
4 of the first and second coils are adapted to flow currents
5 in different directions at a same position.

1 5. The magnetostrictive torque sensor, according to
2 claim 1, wherein:

3 the first and second coils are formed in a shape of
4 zigzag on front and back surfaces of a flexible board, and
5 formed by folding this flexible board with an angle of 180°.

1 6. The magnetostrictive torque sensor, according to
2 claim 2, wherein:

3 the first and second coils are connected between a pair
4 of the semi-cylindrical ferrite magnetic cores to compose the
5 bridge circuit.

1 7. The magnetostrictive torque sensor, according to

2 claim 1, wherein:

3 the first and second coils respectively comprises a
4 first terminal connected to a first and second terminals of
5 an oscillator, and a second terminal connected to a terminal
6 for strain detection to compose the bridge circuit.

1 8. The magnetostrictive torque sensor, according to
2 claim 7, wherein:

3 a differential signal from the bridge circuit is
4 detected by the lock-in amplifier.

1 9. The magnetostrictive torque sensor, according to
2 claim 1, wherein:

3 the first and second coils are accommodated in grooves
4 formed on a pair of the opposed coil-forming inner peripheral
5 surfaces.

1 10. The magnetostrictive torque sensor, according to
2 claim 9, wherein:

3 a pair of the opposed coil-forming inner peripheral
4 surfaces has a length L and a semi-circumference length P of
5 the inner peripheral surface expressed as:

$$6 \quad L \doteq \pi D / 2N \quad (N=1, 2, 3 \dots), \text{ and}$$

$$7 \quad P \doteq \pi D / 2$$

8 wherein D is a diameter of the rotating shaft, and

9 a distance G between adjacent grooves at both ends
10 expressed as:

$$11 \quad G \doteq \pi D / 4N \quad (N=1, 2, 3 \dots).$$